

CLAIMS

1. A software application to generate programs for any robot type from paths pre-determined in 3D design & simulation tools.
2. A methodology for adapting offline simulation programs to the real world environment to counter installation, manufacturing and production errors.
3. A method of programming a robot for operation in a robot manufacturing facility, comprising establishing sets of design data including data relating to dimensions and relative positions of parts of a robot, positions of a robot base and of product handling and transporting equipment in a manufacturing cell and design data relating to dimensions and positions of parts of the proposed product, establishing by processing said data, a robot program, comprising data and instructions for movement of defined parts of the robot for the manufacturing or assembly tasks to be carried out by the robot in that cell, operating a virtual model of the robot in a virtual model of the manufacturing cell to check operability and after such adjustment as may be necessary to ensure operability at the virtual level, operating the corresponding real robot in the real corresponding real cell, with means for sensing the real positions of the operative part or parts of the real robot in relation to a real workpiece or product, supported by the real product handling or transporting equipment, determining corrections required to bring said operative part or parts of the robot into the desired positions with respect to the real workpiece supported by the real product handling and transporting equipment in the cell, and applying these corrections to the design data originally processed to establish a revised robot program for controlling the real robot in the real cell.
4. A method according to claim 3 in which, firstly, a general virtual robot program is established using, for the design data relating to the robot,

parameters common to a plurality of different robots suitable for use, or even using only coordinates describing positions and orientations of a robot tool in a reference frame fixed with respect to the factory space local to the cell concerned and a program suitable for a specific robot is determined by applying to said general program a program header specific to that robot and defining parameters in that general program in terms of known design parameters specific to the particular robot concerned.

5. Apparatus for use in programming a robot for use in a manufacturing cell in a manufacturing facility, including sensing means for sensing the real positions of an operative part or parts of the robot in relation to a real workpiece, and for relaying the resulting positional information back to a control facility controlling the robot in accordance with pre-programmed parameters, said control facility including computing means running a program such that the control facility is arranged to adjust said parameters so as to minimise discrepancies between the real and design positions of said operative part or parts relative to the tool.

6. A method of programming a robot substantially as herein before described.

7. Apparatus for use in programming a robot substantially as herein before described.